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Interactive comment on "The sulfur- and halogen-rich super eruption Los Chocoyos and its impacts on climate and environment" *by* Hans Brenna et al.

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This paper needs to be revised. Because of the way the simulations were carried out, and because of the lack of explanation or justification of the sulfur and halogen emissions used, the conclusions need to be framed as, "We simulated the eruption of Atitlán in recent pre-industrial times, with 523 MT sulfur (or SO2? – it is not clear), 1200 MT chlorine, and 2 Mt bromine emissions. The results may have been similar for Los Chocoyos, but because we did not do the simulation with its initial conditions, and because we do not know what its emissions were very precisely, we cannot say. As expected, if there were large halogen emissions, the climate response was different

that if the volcano only emitted sulfur into the stratosphere." If the authors make those changes and those below and address the 55 comments on the attached annotated manuscript, then it should be acceptable for publication.

The introduction is overly long. There is no need to review every paper ever written on the impacts of supereruptions. Only include the ones you will refer to later.

On the other hand, section 2.1 is much too short. The authors give no details about how they determined the emissions from the eruption, nor the errors associated with that determination. And why did they not use ice core data?

Section 2.2 is also too short. They say they use CLM5, but with what settings? 1850 vegetation? Dynamic vegetation? Crop model turned off?

The metric Mv is used for volcanic eruptions, without ever explaining what it is and why it is relevant for the impact of volcanic eruptions on climate. If it is a geological measure of explosivity, then it is not appropriate. You might want to look at the discussion on pp. 3-4 of Newhall et al. (2018). Is it the same as the M discussed there?

Newhall, Christopher, Stephen Self, and Alan Robock, 2018: Anticipating future Volcanic Explosivity Index (VEI) 7 eruptions and their chilling impacts. Geosphere, 14, No. 2, 1-32, doi:10.1130/GES01513.1.

How could 1850 initial conditions be representative of the climate and the climate forcings at the time of the LCY eruption?

The authors use ONI without ever defining it or giving a reference. What is it? Is it the same as the Niño3.4 temperature anomaly?

The term "pentadal" is used in the text and figures without every defining it. What does it mean? What pentad?

There are several unacceptable references from papers to be submitted.

In general, the supplemental figures are missing a lot of information in their captions.

They should be understood without having to search the main paper for definitions. All acronyms and terms need to be defined.

Fig. S1(a) is missing the changes from December to January. Plot January on both sides so it gives the entire seasonal cycle and indicate months with their names, not numbers.

Fig. S2: What does pentadal mean? It has to be explained.

Fig. S2: Add a vertical axis in height on the right side of the figures.

Fig. S2: How are the anomalies calculated? And why are there no error bars?

Fig S3: How can 12-month running means start at 0?

Fig. S4: You have an entire page. Why not fill it with the figures rather than use tiny ones at the top of the page. And change "indicates" to "indicate." Also, it needs a fourth panel with the difference between panels (b) and (c). They look identical as plotted. Isn't the difference the important information?

Review by Alan Robock

Please also note the supplement to this comment:
https://www.atmos-chem-phys-discuss.net/acp-2019-827/acp-2019-827-RC1-supplement.pdf